

Avian influenza
in Africa

Targeting vigilance

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In 2006, the detection of the avian influenza (flu) H5N1 virus in Africa caused great concern: the virus could spread to the whole continent, and then be reintroduced to Europe by migratory birds. Epidemiological surveillance programmes were set up and national mechanisms strengthened with the support of international organisations. At the same time, research programmes were launched to describe and understand the virus transmission processes in Africa, and to assess the risks.

Among these programmes, the GRIPAVI project is aimed at characterising the circulation of avian influenza viruses and Newcastle disease in both wild birds and domestic poultry. It shows that the African continent is not free from risk and that vigilance should continue. By specifying the virus persistence mechanisms in Africa and identifying risk situations, it proposes avenues for targeting surveillance and control strategies and thereby making them more efficient.

In 2006, the highly pathogenic avian influenza H5N1 virus was detected for the first time in Africa in poultry farms in Nigeria and Egypt; it then occasionally affected Niger, Cameroon, Burkina Faso, Sudan, Côte d'Ivoire, Ghana, Togo and Benin. There was considerable concern: the virus could spread to the whole continent before being reintroduced to Europe by migratory birds. This fear was consolidated by the lack of resources available to African structures for dealing with a potential health crisis, and by a lack of understanding of the influenza virus transmission processes in wild and domestic bird populations in tropical Africa.

International organisations rapidly mobilised to strengthen surveillance and control systems, especially to increase testing and diagnosis capacities. However, in the long

term, most African countries are faced with an ongoing shortage of human and financial resources. They therefore need to adapt surveillance and control strategies in order to make them more efficient.

Several international monitoring and research programmes were launched in Africa, including the GRIPAVI project (see box, p. 4). This project focuses on both avian influenza viruses and Newcastle disease, and on host populations of domestic and wild birds, which is what makes it original. The goal is to characterise the distribution of the viruses in wild and domestic birds and to identify the drivers and mechanisms of virus circulation.

Five years later, in 2011, although several strains of the H5N1 virus are still rife in

perspective

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The highly pathogenic avian influenza viruses affecting domestic poultry generally stem from low pathogenic strains circulating among wild birds.

Asia and seem to have taken hold in Nigeria and Egypt, they have not spread to the whole of the African continent, nor do they appear to have passed from Africa to Europe. Is Africa safe from a serious avian influenza crisis?

Research shows that avian influenza viruses are nevertheless circulating in Africa among wild and domestic birds, as are other viruses, such as Newcastle disease.

Viruses common to wild and domestic birds

No healthy carriers of the highly pathogenic H5N1 virus were found among the thousands of wild birds tested in Africa. This result is in line with those of all the surveillance programmes conducted at the global level since 2006 (with very few exceptions).

However, low pathogenic avian influenza viruses have been regularly detected in wild birds in numerous parts of Africa, especially among the Eurasian wildfowl, which winter in Africa, and in African wildfowl that live in tropical Africa all year round. The proportion of infected birds (prevalence) is never-

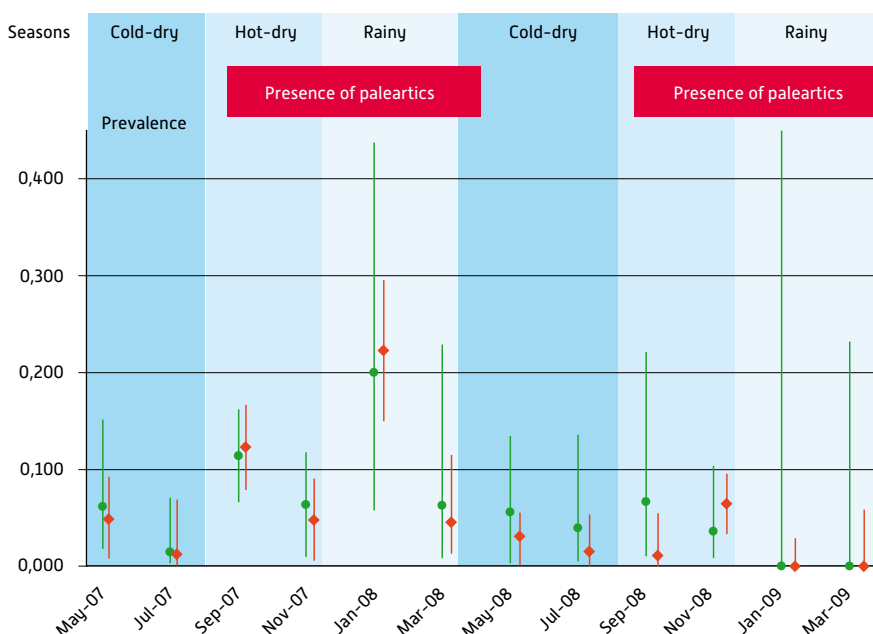
theless lower than in temperate zones. This prevalence is statistically correlated with the local density of birds and with the date of arrival of migratory birds in Africa. In addition, in the Inner Niger Delta in Mali, modelling of the spatial distribution of birds using environmental data such as flooded areas made it possible to assess the density of bird populations and the associated risk of avian influenza virus circulation. This risk increases when the density of wild birds is higher, especially during low rainfall years with little flooding.

Furthermore, samples taken in Mali and Zimbabwe revealed for the first time the year-round circulation of these viruses in communities of wild birds (see diagram below).

In domestic birds, the circulation of low pathogenic avian influenza viruses is limited. It is far less intense than that of the Newcastle disease virus, an avian disease that is similar in clinical terms and is harmless to humans, but is the cause of considerable economic losses in Africa. The Newcastle disease virus has also been found, with a high frequency, in many wild bird species, and certain potentially pathogenic strains of this virus have been identified in both poultry and wild bird populations.

As on other continents, African birds, whether domestic or wild, migratory or resident, thus contribute to the circulation and maintenance of avian influenza viruses. For Newcastle disease at least, wild and domestic birds may also host the same pathogenic virus strains. This fact suggests contact between populations or individuals that exchange pathogens.

Waterfowl carrying low pathogenic avian influenza viruses are present all year round on the Manyame and Chivero lakes (Zimbabwe).



Mean prevalence values (with confidence interval). Green circle: value for waterfowl; red circle: value for all species.

Source: Caron A. et al., 2010. Persistence of Low Pathogenic Avian Influenza Virus in Waterfowl in a Southern African Ecosystem. EcoHealth, DOI: 10.1007/s10393-010-0356-4.

Contacts and exchanges, key factors in virus circulation

Contacts between wild and domestic birds play a key role in virus circulation. Avian influenza health crises affecting domestic poultry are in fact caused by highly pathogenic viruses that generally stem from low pathogenic strains circulating among wild birds. These viruses are transmitted to poultry by direct or indirect contacts. Characterising the contacts between wild and

In Mali, the end of the dry season is the peak period for contacts between wildfowl and poultry.

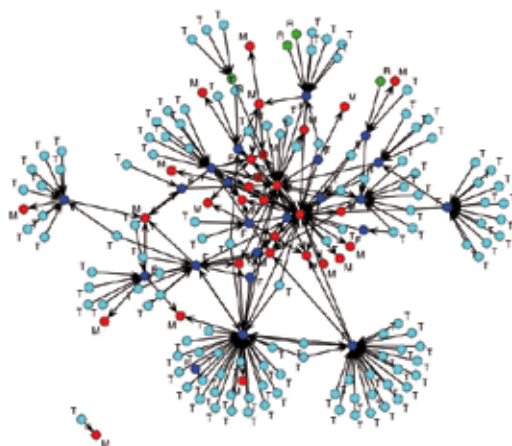
domestic populations and assessing their likelihood is therefore a key element for estimating the risks of an epidemic.

In Mali, tracking African wildfowl using satellite telemetry has shown that the end of the dry season is the peak period for contacts between wildfowl and poultry. Indeed, at this time, the two populations share the same habitats, just outside villages.

In Zimbabwe, an analysis of the bird communities cohabiting at the interface between villages, poultry farms and natural wetlands identified the species that are potentially involved in virus transmission between wild and domestic populations. Indeed, these species present ecological characteristics (abundance, mobility, feeding patterns) that foster contacts with both waterfowl and poultry.

The role of trade in virus dissemination is no longer questioned. It was following the importation of day-old chicks that the H5N1 virus was introduced to Nigeria and Egypt. At a more local level, the mixing of domestic populations on markets also increases the risks of virus circulation. Whether in Madagascar, Mali or Ethiopia, surveys have shown that frequenting markets or the proximity of bird traders is linked to a higher prevalence of Newcastle disease viruses on farms. In Madagascar, the risk of infection at district (fokontany) level is statistically linked to the density of trade flows.

Analysis of exchange networks for poultry helps to identify the main nodes to monitor. (Sikasso, Mali).



Source: Molia S., unpublished.

Using the systems network analysis applied to the poultry sector made it possible to assess the main exchange nodes and circulation pathways for domestic birds. For example in Mali, in the Sissoko region, this approach shows how markets, villages or farms are connected (see diagram below). It is thus possible to assess the risk of virus circulation and to use this to set priorities for surveillance.

The limited impact of migration

Certain episodes of H5N1 virus expansion to the continental level in Asia and Europe appear to be linked to movements of infected wild birds.

Different laboratory studies have shown that captive wildfowl infected by the H5N1 virus are capable of excreting this highly concentrated virus over several days, without any clinical signs, or before these develop. What about in nature? Can a bird excrete and thereby spread the virus as it travels, especially during long intercontinental migrations?

Using satellite telemetry, the individual journeys of more than 200 wildfowl were analysed during their migration between Africa, Europe and Asia. Given the duration of asymptomatic infection measured in experimental conditions, these analyses show that migratory wildfowl are able to disperse the virus over long distances (up to 2 000 km in 4 days). But the probability of this happening for a bird is low: this bird would have to catch the virus just before making a major migratory journey, an event that is likely to happen on only 5 to 15 days per year on average for a bird.

Maintaining vigilance and targeting action

Although no major health crisis linked to the H5N1 virus has occurred at continental level, vigilance must continue in Africa. This continent satisfies all the conditions for the persistence and emergence of potentially dangerous pathogens, carried by

A few words about...

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both wild and domestic birds. Furthermore, highly pathogenic strains of avian influenza virus and of Newcastle disease are already present in some countries, which surveillance and control measures cannot always keep under control.

By identifying risk situations, the GRIPAVI project suggests avenues for improving the efficiency of surveillance. Rather than the systematic surveillance of wild birds, which is costly and difficult to put in place, it suggests focusing on wetlands with high concentrations of wild birds situated close to farms. In the Inner Niger Delta, for example, surveillance could focus on migratory waterfowl during low rainfall years, when density is maximal, at the peak of the dry season (January and February). It recommends monitoring contact situations between wild and domestic birds: for example, alongside domestic fowl, the Mopti and Bamako markets in Mali sell a large quantity of waterbirds when the level of the Niger River drops considerably, which facilitates hunting.

The domestic birds populations that are at risk are also better identified thanks to the knowledge acquired – composition, management methods and intensity of exchanges, especially on markets. Thus, on certain occasions, such as traditional celebrations in Ethiopia, Mali or Madagascar, bird exchanges and circulation increase, as do the risks of virus dissemination.

In addition to targeting surveillance at risk situations, prevention is another avenue to be explored. Classic biosecurity measures have proved their efficiency in commercial farms in Mali. Research would be useful to adapt these to family farms, which are pre-dominant in Africa.

Whatever the path chosen, analysis shows that it is important to adapt proposals to the specific conditions of the country or region. ■



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The GRIPAVI project is based on the findings of other research and surveillance projects in Africa with which CIRAD was associated:

- The FAO Technical Cooperation Programmes (TCP), including
 - Emergency assistance for early detection and prevention of avian influenza (2005-2007);
 - Study on satellite tracking of wild birds (2006-2008).
- Urgent measures to strengthen African laboratories' diagnostic capabilities for avian influenza control (2006-2010), financed by the MAEE.
- The EPIAAF project – Epidemiology of highly pathogenic avian influenza in Africa: identifying risk factors– (2007-2008), financed by FAO and focusing on domestic bird populations.
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